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ORIGINAL RESEARCH

Cost-Effectiveness Analysis of Finerenone for Treatment of Chronic Kidney Disease in Patients with Type 2 Diabetes from Japanese Payer Perspective

Ataru Igarashi · Kenichi Ohara · Hiroyuki Matsuda · Junko Morii · Suchitra Jagannathan · Ronald Filomeno

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ABSTRACT

***Introduction*:** Type 2 diabetes (T2D) is a major cause of chronic kidney disease (CKD) in Japan, and there is an increasing treatment need for first- and second-line care in these patients. The addition of finerenone to current treatment modalities lowers the risk of CKD progression and cardiovascular events in patients with CKD and T2D from the Japanese payer perspective. This study investigated the cost-effectiveness analysis of adding finerenone to standard of care (SoC) versus SoC alone for the treatment of CKD in patients with T2D.

***Methods*:** The FINE-CKD model validated to estimate the cost-effectiveness of finerenone uses the Markov model to simulate the disease pathway of patients over a lifetime horizon. The model was adapted to reflect the Japanese payer perspective and estimated incremental costs, utilities, and incremental cost-effectiveness ratios (ICERs). Sensitivity and scenario analyses were performed to evaluate the effect of the uncertainty of each parameter using a robust model.

***Results*:** The quality-adjusted life years (QALYs) for finerenone and SoC were estimated at 9.39 and 9.25, respectively, with an incremental QALY for finerenone for SoC of 0.14. The total cost of finerenone was estimated at ¥ 8,912,601, at an incremental cost of ¥ 274,052, leading to an ICER of ¥ 1,959,516 per QALY gained compared with SoC alone.

***Conclusion*:** Finerenone in conjunction with SoC is a more cost-effective treatment alternative to SoC alone for adult patients with CKD and T2D from a Japanese healthcare payer perspective.

Keywords: Chronic kidney disease; Cost-effectiveness analysis; Finerenone; Type 2 diabetes

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A. Igarashi
Unit of Public Health and Preventive Medicine, Yokohama City University, Yokohama, Japan

A. Igarashi
Department of Health Economics and Outcomes Research, Graduate School of Pharmaceutical Sciences, The University of Tokyo, Tokyo, Japan

K. Ohara (✉)
Market Access and Public Affairs, Bayer Yakuhin, Ltd., 1-6-5 Marunouchi, Chiyoda-ku, Tokyo 100-8265, Japan
e-mail: kenichi.ohara@bayer.com

H. Matsuda · J. Morii · R. Filomeno
Real World Evidence Solutions & HEOR, IQVIA Solutions Japan G.K., Tokyo, Japan

S. Jagannathan
Real World Evidence, IQVIA, Hyderabad, India

Key Summary Points

Why carry out this study?

Type 2 diabetes (T2D) is a significant cause of chronic kidney disease (CKD) in Japan, leading to increased treatment needs and healthcare costs for managing both first- and second-line care in these patients.

This study evaluates whether adding finerenone to the standard of care (SoC) for treating CKD in patients with T2D is more cost-effective compared to SoC alone, addressing the need for more effective treatments to reduce CKD progression and cardiovascular events.

What was learned from the study?

The study concluded that adding finerenone to SoC is a more cost-effective treatment option for adult patients with CKD and T2D from a Japanese healthcare payer perspective, with an incremental cost-effectiveness ratio of ¥1,959,516 per quality-adjusted life year (QALY) gained compared to SoC alone.

The study confirmed that adding finerenone to SoC is a cost-effective treatment option for patients with CKD and T2D, providing an incremental QALY gain at a reasonable cost.

These findings support including finerenone in CKD and T2D treatment protocols, potentially influencing healthcare policy and resource allocation, with future research needed to validate results and explore the additional benefits or cost-saving measures.

INTRODUCTION

Type 2 diabetes mellitus (T2D) is a major cause of chronic kidney disease (CKD) that is both progressive and irreversible and gradually leads to renal failure (end-stage kidney disease, ESKD) requiring maintenance dialysis or kidney transplant [1, 2]. CKD contributes to a substantial disease burden, with an estimated global median prevalence of 9.5% [3, 4]. It is ranked the 12th leading cause of death, with a 42% rise in the global all-age CKD mortality rate over 20 years [3, 5]. CKD is also associated with an increased risk for cardiovascular disease (CVD) mortality, besides being a risk multiplier for other conditions, including diabetes, proteinuria, anemia, and hypertension.

In Japan, the estimated prevalence of CKD was as high as 13% (over 13 million people) among adults in 2005, based on data from the Japanese annual health check program [6]. Japan has the third-highest occurrence of ESKD in the world, with the number of chronic dialysis patients reaching 2640 per million population [7]. Comorbidities are frequent among patients with CKD, with an increased risk of hypertension, T2D, CVD, proteinuria, and anemia [8]. In Japan, T2D has been associated with the highest risk for kidney failure [9] and ESKD since 1998 [10, 11]. The rise in CKD incidence also correlates with decreasing estimated glomerular filtration rate (eGFR) values [1, 12]. Moreover, lower eGFR levels correlate with increasing CKD severity and contribute to CVD and associated mortality [8].

Healthcare expenses among patients with T2D in Japan have been high due to increasing treatment needs for first- and second-line care in the contexts of CKD and T2D, along with a large number of medications and substantial annual medical expenditures [13]. While moderately progressed CKD and T2D are associated with high clinical risks and healthcare costs, both diseases are synergistically associated with a high risk of cardiovascular events and an increased risk of morbidity and mortality [14, 15].

Disease management for CKD to delay the progression of the disease and for early identification and intervention is recommended in the Kidney Disease: Improving Global Outcomes (KDIGO) guidelines. The treatment algorithm focuses on improving kidney function and achieving well-being using a comprehensive approach to care, including lifestyle management and pharmacotherapies, which have been shown to improve clinical outcomes among patients with CKD and T2D [16, 17]. Recommended lifestyle modifications include diet, exercise, smoking cessation, and maintaining a healthy weight [16, 17]. Pharmacologic agents

either target risk factors for metabolic pathways such as hyperglycemia or the hemodynamic pathway (factors stimulated by the renin–angiotensin–aldosterone system [RAAS] and affecting blood pressure) [18]. Patients with stages 3–4 CKD with an eGFR of ≥ 25–60 mL/min/1.73 mm^2 and moderately or severely increased albuminuria should be treated with RAAS inhibitors, including an angiotensin-converting enzyme inhibitor (ACEi) or an angiotensin II receptor blocker (ARB) [17]. Treatments for hyperglycemia include sodium–glucose cotransporter 2 (SGLT2) inhibitors as first-line therapy and glucagon-like peptide 1 (GLP-1) receptor agonists as second-line therapy [16]. However, patients with CKD and T2D have a residual risk of CKD progression and cardiovascular (CV) events despite current standard-of-care (SoC) therapies and that tends to worsen with more advanced CKD [19]. SGLT2 inhibitors have only shown moderate benefit (11%) for major CV events [20]. The updated KDIGO guidelines recommend the use of nonsteroidal mineralocorticoid receptor antagonists (MRAs) along with RAAS inhibitors and SGLT2 inhibitors for patients with CKD and T2D [16, 17].

Finerenone is a selective nonsteroidal MRA for the treatment of patients with CKD and T2D. Pivotal phase III, double-blind, randomized, placebo-controlled trials (FIDELIO-DKD [NCT02540993] and FIGARO-DKD [NCT02545049]) have investigated the effect of finerenone on delaying the progression of kidney disease and reducing the risk of CV events among patients with CKD and T2D [21, 22]. The patients in these trials received SoC with an ACEi/ARB. These trials showed that finerenone significantly reduced the risk of kidney composite outcome and CV composite outcome among patients with CKD and T2D [21, 22]. On the basis of the favorable clinical outcomes in these pivotal trials [21, 22], the Japanese Ministry of Health, Labour and Welfare granted marketing authorization for finerenone for the treatment of CKD and T2D, excluding patients with ESKD or on dialysis [23]. The pooled FIDELITY analysis of FIDELIO-DKD and FIGARO-DKD confirmed the results of the individual studies and provided robust evidence for CV and kidney protection that was ensured by finerenone across CKD in the T2D spectrum [24]. Nearly 50% of the study participants in the FIDELITY analysis were in the CKD 3 stage. About 97% of the patients in the finerenone population were treated with glucose-lowering therapies, and 7% of the patients were treated with SGLT2 inhibitors or GLP-1 receptor agonists.

The total financial impact of CKD varies across disease stages [25]. Mild CKD, moderate CKD, and ESKD were, for instance, estimated to contribute to 11.5%, 6.5%, and 4%, respectively, of the total healthcare budget in Japan [10, 25]. Moreover, comorbidities substantially increase the total costs associated with CKD [26]. Given this substantial financial burden, it is important to assess the cost-effectiveness of newer therapies. Therefore, this study investigates the cost-effectiveness of adding finerenone to SoC (with ACEi/ARBs) compared with SoC alone for the treatment of CKD among patients with T2D over a lifetime horizon from a Japanese healthcare payer perspective.

METHODS

This study is based on data from previously conducted studies and does not include any new human participants or patients enrolled in this study. Therefore, this study complies with ethical guidelines and did not require an ethics review. The FINE-CKD model uses a Markov modeling approach to compare the cost-effectiveness of adding finerenone to SoC versus SoC alone for the treatment of CKD in patients with T2D. The Markov approach provides a framework for modeling the relationship between CKD progression and the incidence of CV events in regular cycles over a period. Finerenone reduces the risk of clinically important CV and renal outcomes among patients with CKD and T2D [24] and, thus, the study uses the Markov modeling approach to focus on two important dimensions of the clinical value of finerenone.

Patient Characteristics

The modeled population was based on the intention-to-treat (ITT) population from the FIDELITY

analysis, with a mean age of 64.8 years; the proportion of male patients was 69.8% [24]. The trials predominantly included patients with CKD and T2D across the spectrum of CKD severity. Most patients (53.3%) were diagnosed with CKD stage 3 comorbid with T2D, excluding patients undergoing ESKD or dialysis (Table 1).

Interventions

Finerenone was added to SoC and compared with SoC alone. SoC was based on the weighted average of background treatment over the time horizon. Patients with CKD and T2D used RAAS blockers, including ACEi or ARBs, as first-line treatment options.

Model Structure

Model health states were defined according to the stage of kidney disease and history of CV events (Fig. 1). Patients changed health states after experiencing one of the main health events, defined on the basis of the key outcomes of finerenone clinical trials and covering transitions between CKD stages, starting renal replacement therapy, as well as selected CV events and mortality. Additionally, the model included other health events (recurrence of CV events, sustained decrease in eGFR of at least 40% from baseline, new onset of atrial fibrillation/flutter, and hyperkalemia), encompassing a range of clinically meaningful outcomes as an additional layer.

Four stages of CKD progression were considered: CKD 1/2, CKD 3, CKD 4, and CKD 5, based on eGFR levels and without renal replacement therapy. In addition, two stages were considered for ESKD after dialysis and post-renal transplantation (Fig. 1). Patients entered the model in one of the CKD stages in the presence or absence of CV events. Modeled patients remained at the same CKD stage or moved to a more/less advanced CKD stage and/or experienced a first modeled CV event (non-fatal myocardial infarction, non-fatal stroke, and hospitalization for heart failure) or death. Once patients experienced a first CV event, they moved to the post-CV event health state and were not able to move back to the health state without CV events. At any point in the model, patients could experience death, which was appropriately disaggregated to capture the different causes of death (CV or renal).

Patients remained in the same CKD stage for a cycle duration of 4 months, based on the duration of evaluating outcomes in the pivotal trials [21, 22]. The analysis was performed for a lifelong time horizon (up to 100 years of age) to account for the chronic nature of CKD in the context of T2D. A half-cycle correction was applied in the model. Both costs and outcomes were discounted at 2.0% [27]. The cost-effectiveness model calculated quality-adjusted life years (QALYs), total costs, and the incremental cost-effectiveness ratio (ICER) per QALY gained. A willingness-to-pay (WTP) threshold of Japanese yen (¥) 5 million per QALY gained was used to assess the cost-effectiveness results [28].

Clinical Data

The health-state transition probabilities for SoC were estimated from the FIDELITY data analysis [24] (Supplementary Table S1). Transition probabilities included CKD progression, development of ESKD, incidence of the first CV event (transition to the corresponding health state with CV event), both the incidence of the first CV event and deterioration in renal function, and death (renal death, CV death, and death from other causes) (Supplementary Table S2). The transition probabilities for finerenone were estimated by applying the relevant hazard ratios (HRs), assumed to be constant over time. HRs were sourced from the FIDELITY analysis [24] (Supplementary Table S3). HRs were applied to the first and subsequent CV events.

For other health events, transition probabilities for SoC were sourced separately for patients with or without CV events from the FIDELITY analysis [24]. For finerenone, the risk for other health events was estimated by applying the

Table 1 Model input parameters, base-case analysis

Parameters	Value	Source/comment
Age of patients (years)	64.8	Mean value of the overall population for the fidelity analysis
Proportion of male patients (%)	69.8	Percentage of the total population for the fidelity analysis
Baseline patient distribution based on CKD severity		
CKD 1/2	39.88	Percentage of the total population for the fidelity analysis
CKD 3	53.28	
CKD 4	6.84	
CKD 5 (without RRT)	0.00	
Dialysis	0.00	
Kidney transplant	0.00	
Cumulative risk of early termination of finerenone in the fourth year	0.339	Estimated values from the Japanese population for the fidelity analysis
Proportion of patients discontinuing finerenone (1 cycle)	0.028	
Distribution of CV events		
Myocardial infarction	22.79	Estimated from the total population of the fidelity analysis
Cerebral infarction	23.07	
Intracerebral hemorrhage	2.04	
Hospitalization due to heart failure	52.10	
HRs for main CV/renal events, finerenone, [95% CI]		
Onset of eGFR decrease < 15 mL/min/1.73 mm^2 sustained over at least 4 weeks (days)	0.81 [0.67–0.98]	Estimated HR in finerenone versus standard of care in the overall fidelity analysis population
Progression to dialysis	0.82 [0.65–1.03]	
Progression to kidney transplant	1.00 [1.00–1.00]	
CV death[a]	0.88 [0.76–1.02]	
Renal death[b], CKD 5 without RRT	0.53 [0.10–2.92]	
First CV event	0.88 [0.76–1.03]	
Weighted average daily cost of finerenone (¥)	197	
Weighted average daily cost for SoC (¥)	169	

CKD chronic kidney disease, *CV* cardiovascular, *eGFR* estimated glomerular filtration rate, *HR* hazard ratio, *RRT* renal replacement therapy, *SoC* standard of care

[a]CV death includes any death resulting from an acute myocardial infarction sudden cardiac death, sudden death, death due to HF/stroke/CV procedures/other CV causes

[b]Renal death includes any death due to advanced kidney failure/denied dialysis/death due to refusing dialysis

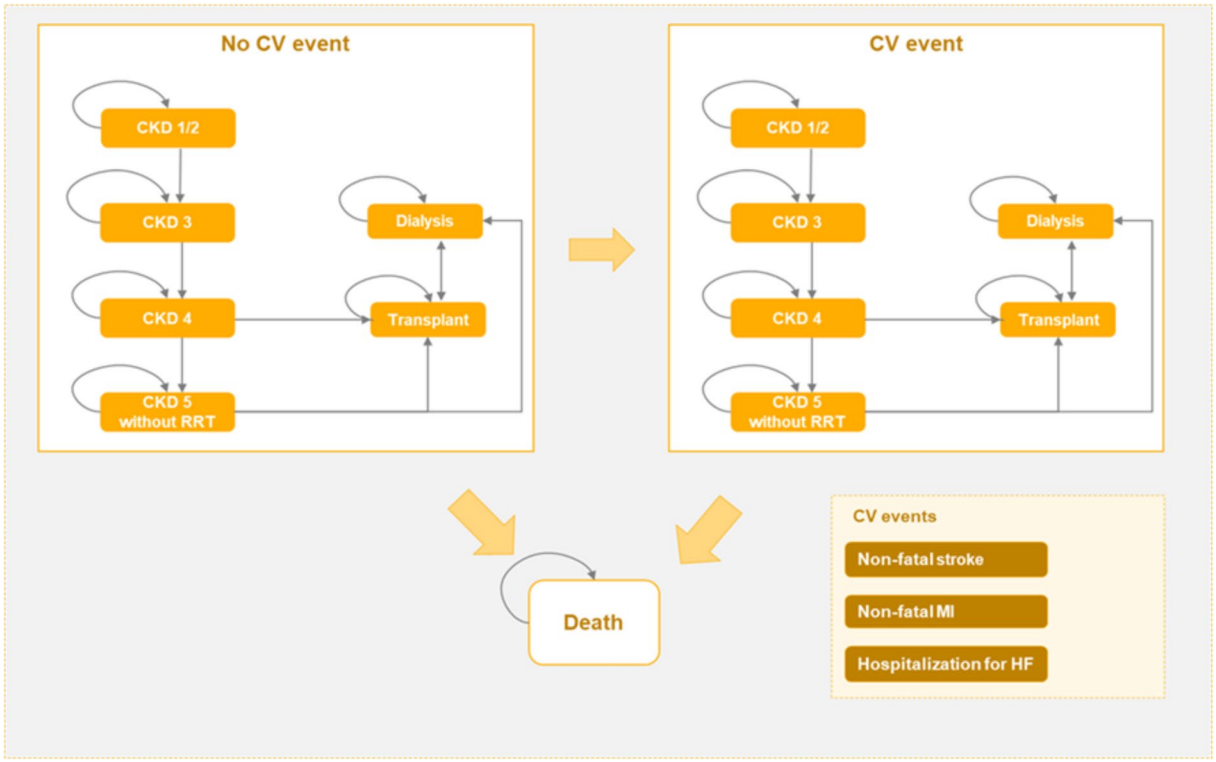

Fig. 1 Model structure. *CKD* chronic kidney disease, *CV* cardiovascular, *HF* heart failure, *MI* myocardial infarction, *RRT* renal replacement therapy

HRs sourced from the FIDELITY analysis [24] (Supplementary Table S4).

Utilities

The model applied a two-step approach to calculate the utilities. First, the results of a multivariate regression (multilevel mixed repeated measurements) model, based on FIDELITY, were used to estimate the utility values for main health events and utility decrements for other health events. Next, the age adjustment multiplier was included to better reflect the impact of age on baseline utility [29] (Supplementary Table S5).

Costs

The model considered only direct medical costs, including costs for medications, health states, and other health events (Table 1 and Supplementary Table S6), and assumed that patients received the same dose of medication for the duration of the model. Costs of other health events were applied to the proportion of patients experiencing those events to calculate total average costs over the time horizon of the model. All cost-related data were obtained by performing a cost analysis from the MDV (Medical Data Vision Co., Ltd.) database [30] and identifying the cohort of patients between October 2013 and August 2019 with at least 1 year of follow-up data for CKD and T2D. Healthcare resource utilization data and the costs of all four CKD stages (CKD 1/2, 3, 4, and 5), dialysis (hemodialysis and peritoneal dialysis), kidney transplantation (acute and post-acute), CV events (myocardial infarction, cerebral infarction, intracerebral hemorrhage, and hospitalization due to heart failure), death (CV and renal death), and other health events were obtained from this cost analysis (Supplementary Table S6).

The price per day for finerenone was calculated as a weighted average of the prices of two

different doses (10 mg and 20 mg), according to the percentage of their use in FIDELITY [24] (Supplementary Table S7). For SoC, all commonly used therapies among patients with CKD with T2D in Japan were included and based on the claims database analysis [30]. The cost of SoC was the sum of all treatments weighted by the percentage of patients who used each therapy in the FIDELITY analysis [24] (Supplementary Table S7). All drug costs were obtained from the drug price list, April 2022 [31].

Base-Case Analysis

The base-case analysis compared finerenone plus SoC with SoC alone from the Japanese payer perspective. The cost for finerenone considered the brand drug price, and the total ITT population from FIDELITY was taken into consideration.

Sensitivity Analysis

One-dimensional sensitivity analysis was performed to assess the uncertainty of the results due to variations in individual parameters. The analysis was performed with a 95% confidence interval (CI) based on the probability distribution set for each parameter. A variation of 20% of the average estimate was assumed where parameters did not achieve the 95% CI. The top ten parameters with the greatest impact on the ICER were depicted as a tornado diagram.

A probabilistic sensitivity analysis using 1000 Monte Carlo simulations was performed to assess the uncertainty of the analytical results. The probability distribution and range of parameters assumed in the stochastic sensitivity analysis were based on their parameter distribution. A scatter plot of the cost-effectiveness plane based on the results of the probabilistic sensitivity analysis and the cost-effectiveness acceptability curve was used to depict the results.

Scenario Analysis

The model considered two scenarios: First, the price of the SoC was set to the cost of the generic drug (Supplementary Table S7). Second, only the Japanese patient population from the FIDELITY analysis was included in the model instead of the overall ITT population. The model inputs for this scenario are shown in Supplementary Tables S8–S12.

RESULTS

Base-Case Analysis

The QALYs for finerenone and SoC were estimated at 9.39 and 9.25, respectively, with an incremental QALY for finerenone for SoC of 0.14. The total cost of finerenone was estimated at ¥ 8,912,601, at an incremental cost of ¥ 274,052, leading to an ICER of ¥ 1,959,516 per QALY gained compared with SoC alone (Table 2). Since the ICER was within the WTP threshold of ¥ 5 million per QALY gained, the addition of finerenone to SoC was considered a more cost-effective treatment alternative than SoC alone from the Japanese payer perspective.

Overall, the finerenone group had lower costs compared with the SoC group for CKD-related health conditions, the first CV event, other health events, and mortality. Despite cost offsets in dialysis (¥ 662,256), the first CV event (¥ 1,849,002), and other health events (¥ 1,178,819), the added cost of finerenone to SoC (¥ 274,052) resulted in a higher total cost for finerenone plus SoC versus SoC alone (Table 2).

One-Way Sensitivity Analysis

A one-dimensional analysis was used to determine the variation (95% CI) within each parameter. The sensitivity analysis compared finerenone plus SoC with SoC alone, and ten parameters with the highest impact on ICER were represented as a tornado diagram (Fig. 2). The most influential parameters of base-case ICER values were cardiovascular death HR (1,556,955–5,263,421 circle/QALY) for the standard treatment group in the finerenone group, followed by initial cardiovascular event HR (545,117–3,960,735 circle/QALY) and baseline patient distribution based on the severity of CKD (2,855,188–504,702 circle/QALY). Detailed

Table 2 Base-case results

Parameters	Finerenone	SoC	Incremental difference
QALYs	9.39	9.25	0.14
Costs (¥)	8,912,601	8,638,549	274,052
ICER (¥ per QALY gained)	1,959,516	–	
Cost-breakdown (¥)			
Medication cost	1,139,685	674,586	465,099
CKD-related health status costs	3,830,917	3,869,786	− 38,869
CKD treatment	3,054,341	2,992,374	61,967
Dialysis	639,281	724,696	− 85,415
Kidney transplant	137,295	152,716	− 15,421
First CV event	1,802,342	1,881,145	− 78,803
Other health events costs	1,141,709	1,218,957	− 77,248
Subsequent CV events	964,979	1,073,640	− 108,661
Hyperkalemia leading to hospitalization	12,548	6722	5826
Reduction in eGFR by ≥ 40% from baseline	22,581	24,510	− 1929
New onset of atrial fibrillation/flutter	45,878	49,880	− 4002
Hyperkalemia, not leading to hospitalization	95,722	64,204	31,518
Death costs	645,154	646,887	− 1733

CKD chronic kidney disease, *CV* cardiovascular, *eGFR* estimated glomerular filtration rate, *ICER* incremental cost-effectiveness ratio, *QALY* quality-adjusted life year, *SoC* standard of care

results of the sensitivity analysis are shown in Supplementary Table S13.

Probabilistic Sensitivity Analysis

A stochastic sensitivity analysis using 1000 Monte Carlo simulations was performed to assess the uncertainty of the cost-effectiveness, based on the assumed probability distribution and range of parameters. The probabilistic sensitivity analyses were depicted as a scatterplot for the cost-effectiveness plane based on the stochastic sensitivity analysis. A majority of the simulations were situated in the northeast quadrant (Fig. 3a). These results were further complemented with a cost-effective acceptance curve, which showed that finerenone had an 89.9% probability of being more cost-effective than SoC at the given WTP threshold of ¥ 5 million per QALY gained (Fig. 3b).

Scenario Analysis Results

Two scenario analyses were performed to evaluate cost-effectiveness. The first scenario analysis considered the cost of generic drugs for SoC treatment, and all parameters influencing the cost of the SoC were determined. The use of finerenone resulted in a gain in QALYs (0.14) and an incremental cost of ¥ 269,425, leading to an ICER of ¥ 1,926,436 per QALY gained, which was lower than the base-case ICER (Table 3). Since the ICER

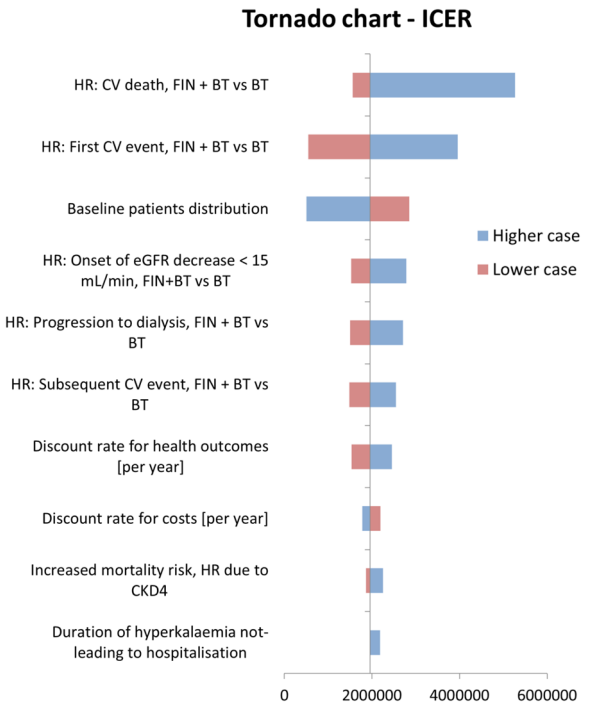

Fig. 2 Tornado diagram depicting one-dimensional sensitivity analysis results for finerenone plus SoC versus SoC alone. *BT* standard treatment, *CKD* chronic kidney disease, *CV* cardiovascular, *eGFR* estimated glomerular filtration rate, *FIN* finerenone, *HR* hazard ratio, *ICER* incremental cost-effectiveness ratio

was within the WTP threshold of ¥ 5 million per QALY gained, the addition of finerenone to SoC can be considered a more cost-effective treatment alternative to generic SoC.

In the second scenario analysis, the Japanese population was considered from the FIDELITY analysis, in accordance with the analytical framework determined by the cost-effectiveness analysis. In this scenario, finerenone use resulted in a decrease in QALYs (– 0.26) at an incremental cost of ¥ 941,652 (Table 3). Thus, finerenone plus SoC was dominated by SoC alone for this population.

DISCUSSION

The present study assessed the cost-effectiveness of adding finerenone to SoC for the treatment of adult patients in Japan with CKD associated with T2D. The addition of finerenone is cost-effective from both the healthcare and societal perspectives. Our results showed that finerenone along with SoC led to higher QALYs, and, thus, it can be considered a more cost-effective treatment alternative to SoC alone.

The economic evaluation of the cost-effectiveness of finerenone added to SoC to delay CKD progression and reduce the CV risk in patients with CKD and T2D was assessed. Thus, a model-based economic evaluation of finerenone reflects the clinical benefits of using finerenone, as demonstrated in both clinical trials, FIDELIO-DKD and FIGARO-DKD. The model population reflects both clinical trials and is based on the pooled FIDELITY patient population for patients with CKD and T2D. While several assumptions were made to optimally reflect clinical practice in the model, the estimates generated by the model correspond well with the FIDELITY results and reflect the expected treatment. Thus, finerenone is expected to confer a benefit in terms of CV risk by reducing the risk of time to first occurrence of CV death, non-fatal myocardial infarction, and non-fatal stroke or hospitalization for heart failure by 14% over 3 years [32]. The FINE-CKD model has previously been used to assess the cost-effectiveness of finerenone in the Netherlands; however, the model used clinical data for patients with predominantly advanced CKD and T2D from the FIDELIO-DKD trial with a median follow-up duration of 2.6 years [21, 33]. Finerenone plus SoC was found to incur higher QALYs at a lower cost and was dominant over SoC alone [33]. The current study is the first cost-effectiveness analysis of finerenone using the updated FINE-CKD model, which employed clinical data for the entire ITT population from the FIDELITY pooled analysis with a median follow-up of 3.0 years [24]. Thus, the model reflects the expected treatment in the Japanese population and allows for a reliable assessment of both benefits and costs related to the use of finerenone among patients with CKD and T2D.

There was minimal difference in the incidence of CV and renal endpoints in the Japanese population of the fidelity analysis, due to the small size of the population rather than the heterogeneity within the population [24]. Hence,

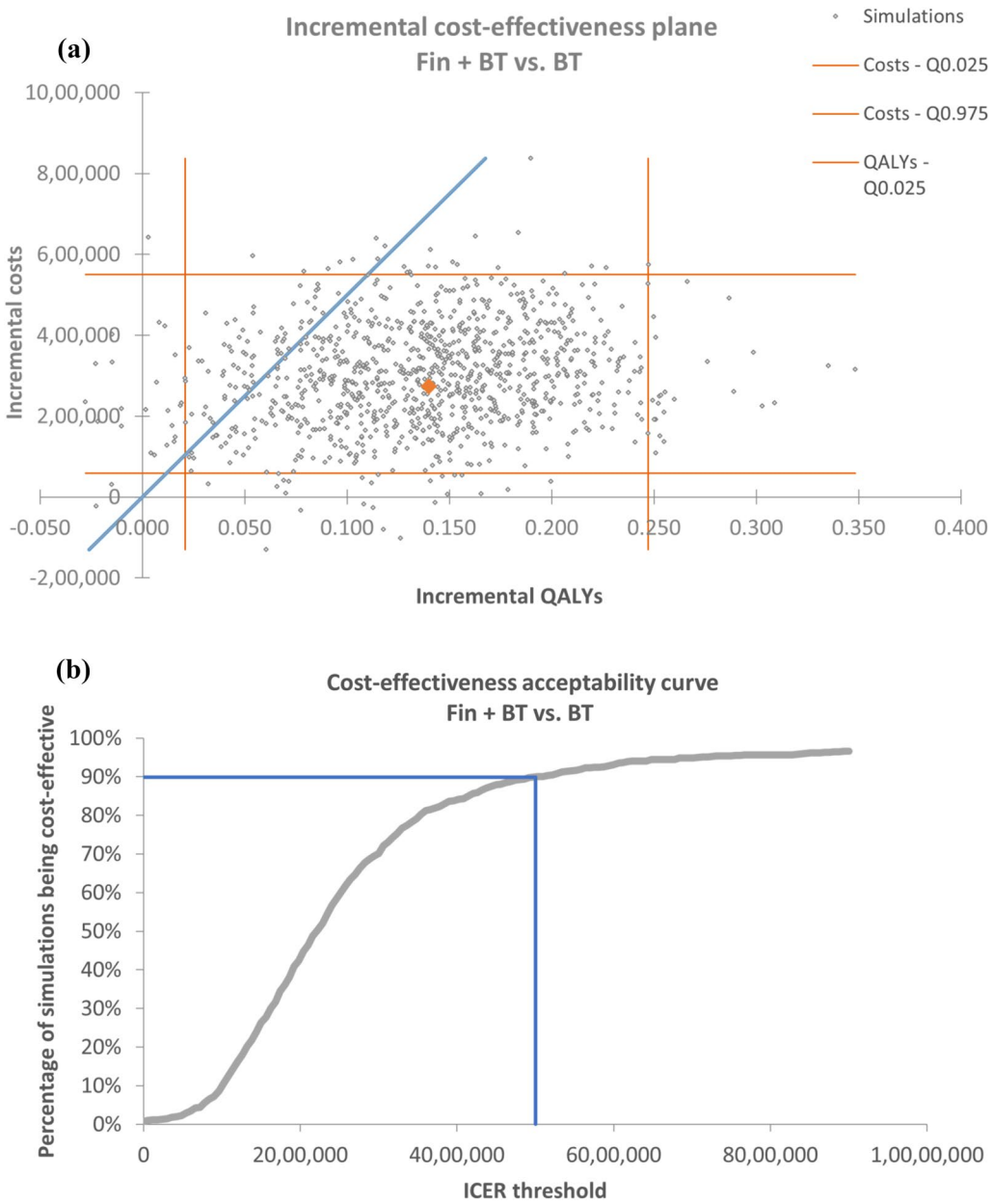

Fig. 3 Cost-effectiveness scatter plot (**a**) and cost-effectiveness acceptability curve (**b**) depicting probabilistic sensitivity analysis results for finerenone plus SoC versus SoC alone. *BT* standard therapy, *FIN* finerenone, *QALY* quality-adjusted life year, *ICER* incremental cost-effectiveness ratio

finerenone was considered useful for evaluation of SoC compared to the Japanese population for a cost-effectiveness analysis. Owing to the small sample size of the Japanese population and limited number of patients for evaluation, the number of events that could be evaluated to meet the endpoint was low, along with a wide range of heterogeneity (patient background). Hence the data of the fidelity analysis can be considered a basic analysis using the Japanese population for a sensitivity scenario analysis for a cost-effectiveness model. The strength of the study is that the validated model structure represented the disease pathway of patients with

Table 3 Scenario analysis results

Parameters	Finerenone	SoC	Incremental difference
Scenario #1			
QALYs	9.39	9.25	0.14
Costs (¥)	8,574,079	8,304,654	269,425
ICER (¥ per QALY gained)	1,926,436		
Scenario #2			
QALYs	10.16	10.43	− 0.26
Costs (¥)	8,227,142	7,285,490	941,652
ICER (¥ per QALY gained)	Dominated		

ICER incremental cost-effectiveness ratio, *QALY* quality-adjusted life year, *RRT* renal replacement therapy, *SoC* standard of care

CKD associated with T2D. Moreover, the model is based on clinical data and captures the impact of chronic disease from the healthcare and societal perspectives.

CKD-related health status was determined at each of the four CKD stages, based on eGFR levels. Health conditions after the acute phase of dialysis and kidney transplantation were assessed, and event risk, quality of life, and cost were assigned to each health status. The cost of health status for CKD 1/2 and CKD 3 was previously reported at 34,000 JPY–45,000 JPY and 57,000 JPY per 4 months, respectively. However, in the present study, analysis estimates of ¥ 97,816 per 4 months for CKD 1/2 and ¥ 86,845 per 4 months for CKD 3 were higher than in previous studies. These estimations appear to be higher than estimates from previous studies among patients with CKD, especially for patients with mild renal damage, since the study was limited to patients with diabetes treated with ACEi or ARB.

Deterministic and probabilistic sensitivity analyses confirmed the validity of our base-case results. The results of the basic analyses show that the ICER was lower than ¥ 5 million. The one-dimensional sensitivity analysis and stochastic sensitivity analysis consistently maintain the validity of the cost-effectiveness of finerenone.

The results of this study should be interpreted considering a few limitations. The model used the individual components of the composite endpoints reported in the FIDELITY analysis; therefore, a few components may not be statistically significant. However, the results of the probabilistic sensitivity analysis validated that the base-case results were robust when the individual component values were varied within their CIs. The health states for the second and all subsequent events were not distinguished, and subsequent CV events were considered in the model within the post-CV event health states as one of the other health events. The analysis that included only the Japanese population was performed as a scenario analysis, resulting in finerenone plus SoC being dominated by SoC alone. It is worth noting that in that analysis, the number of cases with CKD and the number of events with measurable endpoints were few, because the FIDELIO-DKD and FIGARO-DKD clinical trials were not designed to allow for subgroup analysis of Japanese cases alone. Therefore, this scenario analysis should be interpreted with caution, as the results for the Japanese population were underestimated.

CONCLUSION

The results of this study showed that finerenone in conjunction with SoC could be a more cost-effective treatment than SoC alone for adult patients with CKD and T2D from a Japanese healthcare payer perspective. Thus, finerenone can be added to SoC to reduce CKD progression and CV events in this patient population.

Author Contributions. Ataru Igarashi, Kenichi Ohara, Hiroyuki Matsuda, and Junko Morii conceived and designed the study; Kenichi Ohara, Hiroyuki Matsuda, and Junko Morii were involved in data collection; Hiroyuki Matsuda and Junko Morii conducted the analysis; Suchitra Jagannathan drafted the first version of the manuscript. All the authors reviewed and edited the manuscript for intellectual content and gave final approval of the final version.

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Declarations

Conflict of Interest. Ataru Igarashi received consulting fees from Bayer. Kenichi Ohara is an employee of Bayer. Hiroyuki Matsuda, Junko Morii, Suchitra Jagannathan, and Ronald Filomeno are employees of IQVIA.

Ethical Approval. This study is based on data from previously conducted studies and does not include any new human participants or patients enrolled in this study. Therefore, this study complies with ethical guidelines and did not require an ethics review and approval.

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